

Tetradthea fordiana (Elaeocarpaceae), a new species from the Pilbara of Western Australia

R Butcher^{1,3} & L W Sage²

¹ School of Plant Biology (Botany MO90), Faculty of Natural and Agricultural Sciences,
The University of Western Australia, 35 Stirling Highway, Crawley, WA 6009;

² Department of Conservation and Land Management, Swan Coastal District, 5 Dundee Road, Wanneroo, WA 6065;

³ Corresponding author: ✉ ryonen@cyllene.uwa.edu.au

Manuscript received June 2005; accepted September 2005

Abstract

Tetradthea fordiana R. Butcher is described and compared with similar species. It is the northernmost species of *Tetradthea* in Australia, growing on shale associated with ironstone massive outcrops in the Hamersley Range. Like other ironstone endemics in the genus, this species is highly restricted geographically and is listed as Priority One under the CALM Conservation Codes for Western Australian Flora. A taxonomic key to the Western Australian species of *Tetradthea* with two ovules per locule is provided.

Keywords: *Tetradthea*, Elaeocarpaceae, Pilbara, ironstone endemic.

Introduction

There has been considerable recent research into a number of species of *Tetradthea* endemic on ironstone, following the expansion of mining activities in the Koolyanobbing area of Western Australia. In particular, conservation biology studies and taxonomic revisions have been conducted in *T. aphylla* F. Muell., *T. harperi* F. Muell. and *T. paynterae* Alford, Declared Rare Flora (Atkins 2005) which are restricted to small, disjunct ironstone ranges in this area. From this work, there has emerged the description of new subspecies of *T. aphylla* and *T. paynterae* (Butcher *et al.*, in prep.) as well as new species affiliated to both *T. aphylla* (Butcher *et al.*, in prep.) and *T. harperi* (J. Bull, pers. comm.). In her revision of *Tetradthea*, Thompson (1976) noted that many species have extremely localized distributions and suggested that other species might yet be undiscovered as a consequence of being restricted to isolated, under-collected areas. This prediction has been realised over the past decade with the discovery and description of various taxa from isolated hills in the Eastern Goldfields, as well as *T. chapmanii* Alford, a species endemic on sandstone in the Carnarvon Range, Little Sandy Desert (Alford 1995). *Tetradthea chapmanii* was considered the northernmost species of *Tetradthea* in Western Australia until the discovery of the new species described in this paper. The single and opportunistic collection of *T. fordiana*, which constitutes a range extension for the genus of c. 200 km, further supports Thompson's (1976) theory and it can only be supposed that many new taxa still remain to be discovered in this genus.

A number of highly restricted, endemic species of ironstone or sandstone massive outcrops are known from the Eremaean Botanical Province, and the Pilbara bioregion in particular (Western Australian Herbarium 1998). *Dampiera metallorum*, *D. anonyma*, *Tetradthea*

chapmanii and *Scaevola* sp. Hamersley Range Basalts are examples of such species, many discovered and described after recent botanical exploration in the region (Alford 1995; Western Australian Herbarium 1998; Lepschi *et al.* 2004). These species, which often require some level of conservation listing, highlight the need for such mountain ranges to be represented in the conservation estate of Western Australia. *Tetradthea fordiana* is another example of one of these endemics and its description brings the number of named *Tetradthea* species in Western Australia to 27 (Western Australian Herbarium 1998).

Methods

All *Tetradthea* specimens at PERTH were examined for comparison with *T. fordiana*. Due to the dearth of material for this new species, observations and measurements have been made from only the holotype. Stem width and vestiture as well as colour notes have been recorded from the herbarium specimen, with foliage and floral measurements taken from reconstituted fragments.

The following taxonomic key is focused on the Western Australian species of *Tetradthea* which typically have the two ovules per locule character. Taxonomic revisions are ongoing in *Tetradthea* and a full, revised key for the genus has not been constructed. Users are referred to Thompson (1976) and Butcher *et al.* (in prep.) for additional information on species with one ovule per locule.

Taxonomy

Key to species of *Tetradthea* in Western Australia with two ovules per locule

- 1 Stems winged; ovules variable from 1–5 per locule, usually 3 or 4, rarely 2 (Yallingup, Balingup to Cape Riche) .. *T. affinis*

- 1: Stems terete to quadrangular; ovules typically one or two per locule
- 2: Ovules typically one per locule [uniovulate species not considered further]
- 2: Ovules typically two per locule
- 3: Stems with an even distribution of erect, red-brown setae
 - 4: Stems densely covered in broad tubercles bearing erect, stout, somewhat evanescent setae; petiole setose; leaves with flat margins; petals white to pale pink with dark pink spots or pale mauve (Koolyanobbing Range) *Tetratheca* sp. (J.Bull 1).
 - 4: Stems densely hispid and with erect, usually persistent setae arising from small tubercles; petiole hispid, lacking setae; leaves with revolute margins; petals dark pink (Hamersley Range) *T. fordiana*
- 3: Stems smooth to minutely tuberculate, usually glabrous or with scattered glandular hairs or retrorse red-brown setae only at base of branches
 - 5: Anther tube 2.5–3 mm long with a conspicuously 2-lipped orifice (Tammin to Norseman) *T. efoliata*
 - 5: Anther tube 0.6–2 mm long, the orifice oblique or with a longer inner lip
 - 6: Base of plant usually covered with strongly retrorse, dark setae; peduncle glabrous, pink-green to pink-red, 7–16 mm long; leaves with revolute margins (Wongan Hills to Katanning) *T. retrorsa*
 - 6: Base of plant lacking strongly retrorse, dark setae; peduncle scabrous to hispidulous, often with scattered, small glandular hairs, glossy green-red, 1–11 mm long; leaves without revolute margins
 - 7: Stems minutely tuberculate with scattered glandular hairs; calyx segments broadly elliptic (Carnarvon Range) *T. chapuanii*
 - 7: Stems densely covered with rounded to truncate tubercles; calyx segments narrowly triangular to lanceolate (NE of Southern Cross) *T. payuterae*

***Tetratheca fordiana* R. Butcher sp. nov.**

Caules graciles, 0.6–0.85 mm lati, teres, hispidi, setosi; setae erectae, rubiginosae, 0.3–1.2 mm longae. Folia sparsa, persistentia, 1.5–5.9 mm longa, marginibus revolutis. Pedunculi 3–6.3 mm longi, rosei, pubescentes. Calycis lobi 2.2–2.6 mm longi, 1.5–1.7 mm lati, rosei, ovati, pubescentes, marginibus crassis. Petala 5(6), 8.8–9.7 mm longa, 5.8–6.1 mm lata, elliptica ad obovata, rosea. Stamina 10(12), 4.5–5.5 mm longa, rubra, tuberculis paucis oblecta; filamentum 0.6–1.1 mm longum; corpus 2.2–2.8 mm longum; tubus 1.5–2 mm longum. Ovarium dense appresse pubescens et pilis glandulis dense ornatum; ovula 4, in quoque loculo 2.

Typus: West Angelas area, Hamersley Range [precise location withheld for conservation purposes], WA, 03 Sep. 1987, N. Casson X7.1 (*holo:* PERTH 04119630).

Sub-shrub, 0.3–0.4 m in height, with an overall ruby-pink tinge. *Stems* numerous, alternately branched, slender, apices indeterminate but senescing to form a short, blunt, blackened tip, terete, straight, glaucous, terminal branchlets 28–92 mm long, 0.6–0.85 mm wide in flowering region, pinkish-grey hue to younger stems, older stems grey, rugose to broadly striate, densely hispid with an even, moderately dense, covering of short, red-brown, erect setae, 0.3–1.2 mm long, these arising from small, prominent, elliptic, white tubercles that

persist on older stems after setae fall. *Leaves* alternate, sparse, +/- adpressed to stem, usually with 2 setae at base +/- in the stipular position, persistent to tardily deciduous; petiole thickened, red, 0.15–0.45 mm long; blade 1.5–5.9 mm long, 0.5–1.3 mm wide, narrowly ovate to linear, predominantly oblong, acute or obtuse, margins thickened to revolute, often appearing dentate due to scattered marginal glandular hairs, apex terminating in a glandular hair or remnant hair base, appearing mucronate; adaxial surface with spreading to ascending, moderately dense simple hairs; abaxial surface paler with shorter, erect, simple hairs, these predominantly on the thickened, reddish mid-vein. *Flowers* single in leaf axils. *Bracts* paired, 1.2–1.4 mm long, 0.5–0.6 mm wide, ovate, hispid adaxially and abaxially, green with pink apex, midvein and petiole. *Peduncles* strongly curved at base, pink-red, 3–6.3 mm long, 0.3–0.6 mm wide, lightly hispid, very finely striate, expanding gradually along length and fluted at apex before expanding suddenly into a receptacle 0.7–1.2 mm wide, receptacle thickened between each calyx segment, appearing lobed when viewed from below. *Calyx* segments 5(6), inserted just inside top of receptacle, with a small horizontal fold just above base and resting on receptacle margin, ovate, acute to obtuse, slightly concave, 2.2–2.6 mm long, 1.5–1.7 mm wide, caducous, sometimes tardily so, pink, with yellow spot at base internally, lightly spreading hispid externally with fine white spots, hairs shorter and more tangled internally, concentrated along margins and visible from outside, as well as at apex and along thickened midvein, with thickened, reflexed margins. *Petals* 5(6), elliptic to obovate, obtuse, 8.8–9.7 mm long, 5.8–6.1 mm wide with the widest point near the middle to 2/3 length, deciduous, dark pink, paler to yellowish at base internally with a darker pink band through the midline. *Stamens* 10(12), 4.5–5.5 mm long, fused into pairs for 1/2–2/3 of the filament; filaments flattened, angled to curved inwards, yellow, 0.6–1.1 mm long; body +/- straight on inner edge, gently curved on outer edge, then contracting, usually abruptly, into the tube; anther cells prominently separated, the upper two broader than the lower two, outer margins of upper cells shortly acute tuberculate, often with scattered, short, simple hairs, margins of lower two cells with short, spreading, simple hairs, dark red, often paler red on lower two cells, 2.2–2.8 mm long; tube usually arising abruptly from junction with body on outer edge, straight to gently sinuous with a narrow, two-lipped orifice, the outer lip longer than the inner, smooth or with a few tubercles at base on inner surface, red at base, fading to yellow at apex, 1.5–2 mm long. *Ovary* flattened, 1.4–1.8 mm long, 1.1–1.2 mm wide, densely covered with ascending, simple hairs and dense, pale coloured or red-tipped, glandular hairs, green but orange-pink towards margins and at base of style, slightly thickened at base; *style* kinked in mid region with short, simple hairs to c. 3/4 length, red at base fading to yellow at apex, 2.2–2.9 mm long; *ovules* 4, 2 in each locule, the upper ovule attached c. 2/3 of the way along axis, the lower ovule attached near middle. *Fruit* compressed-obovoid, 5.8–6.3 mm long, 4.8–5.3 mm wide, red-brown at base, orange-pink at apex, glossy, lightly hispid with scattered glandular hairs or remnant bases. *Seed* cylindrical, 2.75 mm long, 1 mm wide, tapering at base, truncate at apex, +/- flat on axial side, brown; testa very finely striate, pubescent with erect to very slightly

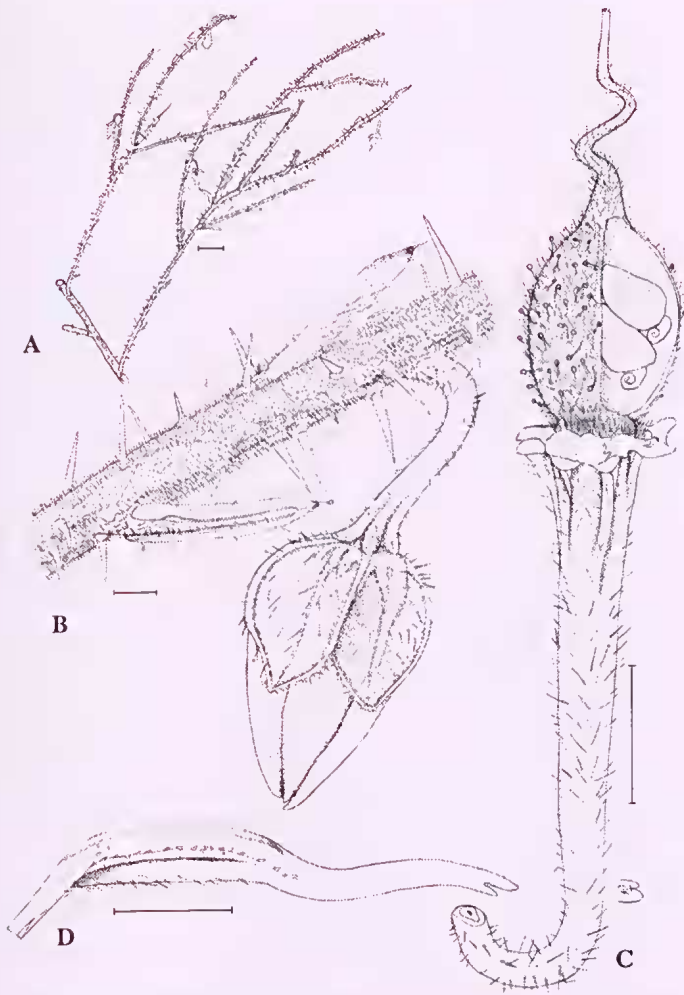


Figure 1 A–D. Illustration of *Tetradthea fordiana*: A – portion of herbarium specimen showing branching pattern; B – portion of stem showing hispid vestiture and tubercle-based setae, leaf arrangement, pubescence and form, and solitary flower bud with ovate, concave calyx segments; C – dissected gynoecium showing dense simple and glandular pubescence on the ovary, two ovules per locule, attached near the middle of the axis, the kinked, pubescent style, as well as the lightly hispid and very finely striate peduncle expanding into a ridged receptacle; D – stamen showing the relative lengths and curvature of the filament, body and tube and the scattered tubercles and simple hairs on the body. Scale bars = 1 cm (A); 1 mm (B–D). Illustrations taken from the holotype.

antrorse simple hairs; *elaiosome* prominent, cream, apparently with broad tubercles along length, +/- terete at base becoming flattened towards apex, irregularly coiled beyond the seed in 2–3 coils, 0.9 mm long in coiled state, with numerous, fine, short, erect hairs. (Figure 1)

Phenology

The holotype was collected in flower and fruit at the start of September.

Specimens examined

Only the holotype has been examined.

Distribution

Tetradthea fordiana is known from only one collection,

from a location in the West Angelas area of the Hamersley Range, in the Pilbara bioregion (Figure 2). Attempts to relocate the species have been unsuccessful.

Regional surveys in the Pilbara, including a specific mountain-top survey, by botanists such as Stephen van Leeuwen and Malcom Trudgen, have not located other populations of the new species. Considering this, and the highly restricted distributions of many other *Tetradthea* species (e.g., *T. chapmanii* of the Carnarvon Range), it is likely that *T. fordiana* occurs only on or near the mountain of the holotype location.

Habitat

Shallow, loose, yellow shale among ironstone on a north-facing buttress, in *Triodia wiseana* hummock grassland with *Eucalyptus kingsmillii*.

Etymology

The specific epithet honours ecologist Douglas Ford, friend and colleague of RB, in thanks for his encouragement and support.

Conservation status

Priority One under the CALM Conservation Codes for the Western Australian Flora (Atkins 2005) is an appropriate ranking for *Tetradthea fordiana*. The new species has been collected only once, from a population of three or four plants (N. Casson pers. comm.), despite a number of specific and regional surveys (S. van Leeuwen & M. Trudgen pers. comm.).

Affinities

Tetradthea fordiana is easily distinguished from all other species by its slender, setose and hispid stems, densely pubescent and glandular hairy ovary, two ovules per locule and its geographic location.

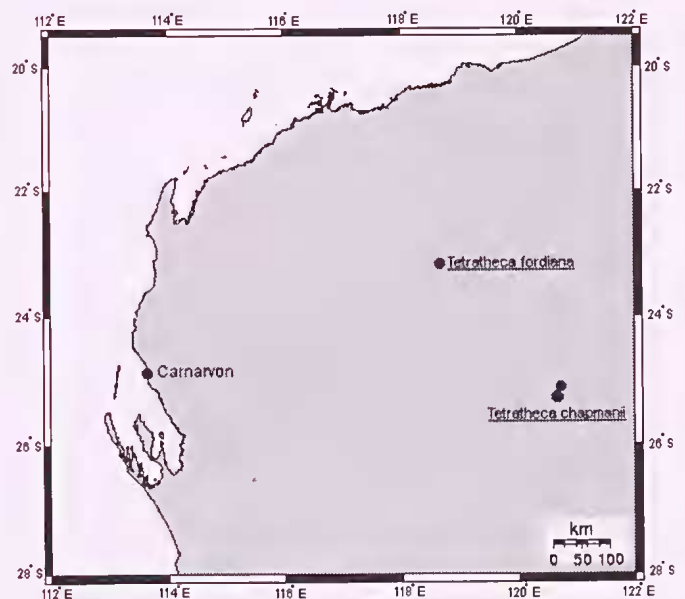


Figure 2. Distribution map for *Tetradthea fordiana*. The single known location of this species is shown relative to the collections of the geographically closest taxon, *T. chapmanii*.

In having two ovules per locule, ovate calyx segments and sparse foliage, *Tetralthea fordiana* resembles *T. chapmanii*, the closest taxon geographically which occurs in the Carnarvon Range, 270 km north of Meekatharra (Alford 1995). Typical specimens of *T. chapmanii* differ from *T. fordiana* in having the stems more or less glabrous except for scattered glandular hairs that are concentrated at the base of the branches, with the same indumentum on its peduncles and calyx segments. Three atypical collections of *T. chapmanii* at PERTH (K. Coate 455; F. Kininworth 24; B. & B. Backhouse *et al.* BEMJ 199) have hispid stems with a sparse, even distribution of antrorse glandular hairs, but field work and further collections through the Carnarvon Range are required to determine whether these represent a different taxon. Unlike *T. fordiana*, the leaves of *T. chapmanii* are caducous, small (c. 1.7 mm long) and triangular, with flat margins, and the affinities of this species appear to lie closer to *T. paynterae*, another 'leafless' species with two ovules per locule that occurs north-east of Southern Cross in the Coolgardie Botanical District (Alford 1995). Although the 'leafless' condition is evidently the result of convergent evolution (Butcher *et al.* in prep.) a comprehensive phylogenetic analysis must be made to assess the affinities between all the species of *Tetralthea* and to ascertain the significance of ovule number as an indicator of relationships.

Tetralthea harperi and *Tetralthea* sp. (*J. Bull* 1) are similar to *T. fordiana* in having glaucous stems covered with erect, coarse setae, but the stems are thicker in these two species, the setae are denser and arise from much broader tubercles, and hispid simple hairs are absent. Of these two species, a closer relationship might be hypothesised between *Tetralthea* sp. (*J. Bull* 1) and *T. fordiana* based on ovule number, with each of these species having two ovules per locule while *T. harperi* has only one. Stamen morphology and vestiture is also

similar between these three taxa, but they differ significantly in the pubescence of the gynoecium; *T. harperi* and *Tetralthea* sp. (*J. Bull* 1) having a glabrous ovary and a +/- straight, glabrous style, while *T. fordiana* has the ovary densely covered in both simple and glandular hairs, and has a distinctly kinked style with short, simple hairs to c. 3/4 of its length.

Acknowledgements: Many thanks to Paul Wilson for the Latin description and Neville Marchant at the CALM Western Australian Herbarium for the provision of facilities. Particular thanks are due to Terry Macfarlane for sharing his insights into the systematics of *Tetralthea*, to Jenny Chappill for her comments on an earlier draft, to Stephen van Leeuwen for his attempts to recollect this taxon and his support of this work, and to Malcolm Trudgen for discussions on habitat and possible distribution. The comments of Kathy Meney and two anonymous reviewers for the improvement of this paper were also appreciated.

References

- Alford J J 1995. Two new species of *Tetralthea* (Tremandraceae), from the Coolgardie and Austin Botanical Districts, Western Australia. *Nuytsia* 10(2): 143–149.
- Atkins K 2005. Priority and Declared Rare Flora List for Western Australia. Department of Conservation and Land Management, Como.
- Butcher R, Byrne M & Crayn D in prep. New taxa within the "leafless" *Tetralthea* Sm. (Elaeocarpaceae) group from Western Australia: evidence for convergent evolution among phylogenetically distant rare species.
- Lepschi B J, Trudgen M & van Leeuwen S 2004. Two new species of *Dampiera* (Goodeniaceae) from the Pilbara region, Western Australia. *Nuytsia* 15(2): 269–276.
- Thompson J 1976. A revision of the genus *Tetralthea* (Tremandraceae). *Telopea* 1(3): 139–215.
- Western Australian Herbarium 1998 – current. FloraBase-The Western Australian Flora. Department of Conservation and Land Management. <http://florabase.calm.wa.gov.au/>